



Attitudes About Prescribing Take-Home Naloxone to Injection Drug Users for the Management of Heroin Overdose: a Survey of Street-Recruited Injectors in the San Francisco Bay Area

Karen H. Seal, Moher Downing, Alex H. Kral,
Shannon Singleton-Banks, Jon-Paul Hammond,
Jennifer Lorvick, Dan Ciccarone, and Brian R. Edlin

ABSTRACT *Naloxone, an injectable opiate antagonist, can immediately reverse an opiate overdose and prevent overdose death. We sought to determine injection drug users' (IDUs) attitudes about being prescribed take-home naloxone. During November 1999 to February 2000, we surveyed 82 street-recruited IDUs from the San Francisco Bay Area of California who had experienced one or more heroin overdose events. We used a questionnaire that included structured and open-ended questions. Most respondents (89%) had witnessed an overdose, and 90% reported initially attempting lay remedies in an effort to help companions survive. Only 51% reported soliciting emergency assistance (calling 911) for the last witnessed overdose, with most hesitating due to fear of police involvement. Of IDUs surveyed, 87% were strongly in favor of participating in an overdose management training program to receive take-home naloxone and training in resuscitation techniques. Nevertheless, respondents expressed a variety of concerning attitudes. If provided naloxone, 35% predicted that they might feel comfortable using greater amounts of heroin, 62% might be less inclined to call 911 for an overdose, 30% might leave an overdose victim after naloxone resuscitation, and 46% might not be able to dissuade the victim from using heroin again to alleviate withdrawal symptoms induced by naloxone. Prescribing take-home naloxone to IDUs with training in its use and in resuscitation techniques may represent a life-saving, peer-based adjunct to accessing emergency services. Nevertheless, strategies for overcoming potential risks associated with the use of take-home naloxone would need to be emphasized in an overdose management training program.*

INTRODUCTION

In the United States, heroin use has become far more prevalent in the past decade, a trend largely attributed to its increasing purity and declining street prices.¹ The increase in heroin consumption has resulted in a burgeoning epidemic of heroin overdose. The number of overdose deaths per 100,000 population in 25 United States cities increased from 8.7 in 1988 to 13.8 in 1997.² San Francisco has one of the highest heroin-related hospitalization rates in the United States (598 admissions

The authors are with the Urban Health Study, Department of Family and Community Medicine, University of California, San Francisco.

Correspondence: Dr. Karen Seal, Urban Health Study, University of California, San Francisco, 3180 18th Street, Suite 302, San Francisco, CA 94110. (E-mail: karens@itsa.ucsf.edu)

per 100,000 people per year),³ and fatal heroin overdoses have reached epidemic proportions in San Francisco, California, representing the third leading cause of years of potential life lost.⁴ In the San Francisco Bay Area during 1998–1999, of 1,427 street-recruited injection drug users (IDUs) surveyed, 685 (48%) reported ever overdosing, with 33% overdosing 2 times or more.⁵

Fortunately, heroin overdose deaths are preventable. Several modifiable risk factors for overdose have been identified,^{6–11} and prevention programs now caution IDUs about injecting heroin when alone, while using other central nervous system depressants (alcohol and benzodiazepenes), and after periods of abstinence, such as following release from jail or drug treatment. Most overdoses are witnessed by peers, and death typically occurs 1 to 3 hours after injecting heroin. Both factors provide a window of opportunity for medical intervention.^{6,7,12–14} Companions delay or resist contacting emergency services (calling 911) because they fear that notifying the authorities of their drug use may lead to interrogation or arrest.^{10,14–16} Thus, the majority of overdoses are handled by laypersons.^{10,14,15} Few IDUs have been adequately trained in cardiopulmonary resuscitation (CPR), and therefore their attempts at resuscitation are often unsuccessful.^{13–15}

Heroin overdose fatalities may be effectively prevented through the timely injection of naloxone.^{12,17} In the United States, naloxone is classified as a legal, unscheduled opiate antagonist and is routinely used by paramedics and medical personnel to quickly and safely reverse heroin overdose.^{17,18} When administered as a single intra-muscular or intravenous dose, recovery from heroin overdose is virtually universal, and serious adverse side effects are rare.^{13,19} Because naloxone has a relatively short half-life of 30–80 minutes, it rarely may need to be readministered. Naloxone precipitates acute unpleasant withdrawal symptoms in opiate-dependent persons and has no effect on non-opiate-using persons.¹⁷ Naloxone lacks psychopharmacological effects and, as such, lacks abuse potential.

Unlike the “Epi-Pen” (injectable epinephrine) commonly dispensed to laypersons who may have a life-threatening allergic reaction to bee-stings, naloxone is not customarily prescribed to laypersons in the United States. In several European countries, however, take-home naloxone is available to IDUs. In Berlin, Germany, and Torino, Italy, IDUs were provided naloxone; and in both settings, naloxone was used to resuscitate peers successfully.^{20,21} In Chicago, in February 2001, a community-based harm reduction program began making naloxone available to IDUs.²² In January 2001, under a program sanctioned by the state government, physicians in a rural county in northern New Mexico with high rates of heroin overdose began to prescribe take-home naloxone to their heroin-injecting patients (K. Huffman, e-mail communication, 2000). Similar government-sanctioned programs have yet to be initiated in larger urban centers in the United States.

Because of the epidemic number of heroin overdoses in San Francisco, the Department of Public Health has considered prescribing naloxone to IDUs as part of an overdose management program that would include training in overdose prevention, CPR, and the use of naloxone. Several concerns about such a program have been raised, including the danger that IDUs who have naloxone might feel comfortable using larger amounts of heroin and might be less likely to contact emergency services during an overdose than if they did not have naloxone. Furthermore, after administering naloxone to an overdose victim, a peer might abandon the victim or be unable to dissuade the victim from using more heroin to medicate acute withdrawal precipitated by naloxone, increasing the risk of death when naloxone wears off.

Authors in Australia and England have reported on the feasibility and acceptability of distributing naloxone to IDUs to prevent fatal heroin overdose and have considered many of the above concerns.^{23,24} Both groups concluded that naloxone distribution in conjunction with resuscitation training has the potential to save lives, and have advocated for trials of naloxone distribution among IDUs.^{23,24} Nevertheless, to our knowledge, no similar feasibility studies have been conducted in the United States, and local IDU input regarding the benefits and drawbacks to naloxone distribution is critical in designing safe and effective pilot programs in the United States.

We conducted a survey of 82 street-recruited IDUs to determine the following:

1. IDUs' prior experiences and attitudes regarding overdose and the use of naloxone to reverse overdose.
2. Whether IDUs would be interested in participating in an overdose management program wherein which they would be provided naloxone with instruction in its use and in resuscitation techniques.
3. Whether, if provided naloxone, IDUs anticipate that they might engage in behaviors that paradoxically increase risk, such as using greater amounts of heroin.

We report our findings and propose practical suggestions for addressing these putative concerns in the context of an overdose management training program for IDUs.

METHODS

Study Participants

Participants in the Urban Health Study (UHS) of the University of California, San Francisco, were recruited for the present study. Since 1986, UHS has conducted semi-annual surveys of IDUs in inner-city neighborhoods in the San Francisco Bay Area to carry out human immunodeficiency virus (HIV) and hepatitis surveillance, risk reduction counseling, and research.^{25,26} Participants are recruited from street settings by outreach workers and word of mouth using targeted sampling methods.^{27,28} Eligibility is determined by physical evidence of recent injection drug use ("tracks" or multiple venipuncture sites) or participation in previous cross sections of data collection. Trained interviewers conduct in-depth structured interviews to gather information about demographics, medical history, and sexual and injection risk behavior, including overdose.

From November through December 1999 and in February 2000, there were 552 IDUs who participated in the Urban Health Study. A convenience sample of 96 IDUs who reported at least one heroin overdose was invited to return for a 45-minute supplementary interview. The sample was limited by time and financial resources. Participants who returned received a stipend (\$20). Here, we report on the data collected in this supplementary interview. The study was approved by the University of California, San Francisco, Committee on Human Research, and each participant gave informed consent.

Data Collection and Analysis

For the present study, interviewers used a questionnaire that included structured and open-ended questions about participants' last experience with overdose and

naloxone, as well as their attitudes about providing IDUs take-home naloxone with training in its use and in resuscitation techniques. Participants were furnished with a standard definition for heroin overdose that consisted of “stopping breathing” and “turning blue” as opposed to a “heavy nod.” Naloxone was described as the “drug paramedics give a person for a heroin overdose when they’re turning blue or when their breathing stops.” Participants were told that naloxone “works by reversing the effects of any heroin the person has taken and usually causes the person to experience withdrawal or become ‘dope-sick.’” Participants were also informed that, “Naloxone lasts about 30–60 minutes, at which point most people will be fine, but some people may slip back into an overdose and may need further care.” Interviewers briefly described a hypothetical naloxone distribution and training program: “Imagine that you are given take-home naloxone in a pre-loaded syringe to use in case you or a friend overdosed on heroin. You are trained in how to use naloxone and perform CPR.”

The interviews were recorded by audiotape and subsequently transcribed. Open-ended responses were entered verbatim in a standard database. The research team reviewed all open-ended responses, identified emergent themes, and subsequently grouped response themes into categories. The number of responses fitting each response theme category was tallied, and response theme frequencies were calculated. For structured, close-ended items, frequencies and medians with interquartile ranges (IQRs) were calculated.

RESULTS

Characteristics of Study Participants

Of the 96 invited to participate, 82 (85%) respondents returned and were interviewed. Of these, 36% were female; 57% African American, 31% white, 8% Latino, and 4% other race/ethnicities (Table 1). The median age was 46 years (IQR = 40–52 years), and the median duration of injection career was 27 years

TABLE 1. Characteristics of study participants (N = 82)

Characteristics	Percentage
Female	36
Race/ethnicity	
African American	57
White	31
Latino	8
Other	4
Age (median years, IQR)	46 (40–52)
Currently homeless	56
Duration injecting (median years, IQR)	27 (15–33)
Number of lifetime personal overdoses (median, IQR)	3 (1–5)
Time since last overdose, years (median, IQR)	3 (1–12)
Ever received naloxone for an overdose	62
Times received naloxone (median, IQR)	1 (1–3)

IQR, interquartile range.

(IQR = 15–33 years). All respondents had personally experienced at least one heroin overdose; the median number of recurrent overdoses was three, and 62% reported having been treated with naloxone for an overdose.

Responses to Overdose

Most respondents (89%) had witnessed an overdose in the past, and 76% had ever solicited emergency services (called 911) for a witnessed overdose (Table 2). During the last witnessed overdose, the majority (90%) reported initially attempting lay remedies to resuscitate an overdose victim, including immersing the victim in cold water or putting ice on their genitals, slapping them, injecting cocaine, injecting milk or pouring milk in the victim's mouth, and injecting salt water. A sizable percentage (55%) reported attempting CPR or rescue breathing. Only one respondent mentioned that they had injected the overdose victim with naloxone.

About half (52%) of the respondents reported calling emergency services (911) for the last witnessed overdose (Table 2). The median amount of time before calling 911 was 10 minutes (IQR = 3.5–32 minutes). Participants identified several barriers to calling 911 for emergency assistance. Of respondents who did not call 911 for the last witnessed overdose ($n = 37$), most (74%) cited fear of police involvement or legal repercussions: "Dope fiends have warrants or are on probation," "I called 911 to save a friend; ended up in jail." Of those who did call 911 the last time ($n = 45$), 42% mentioned that police accompanied the paramedics. No arrests occurred, yet several participants noted that police interrogated those present about drugs, searched them, checked for parole violations and warrants, or treated them disrespectfully. Nevertheless, 74% of all respondents reported that, if they overdosed, they would want 911 called right away: "I want to live"; "I'm not ready to die."

Experiences with Naloxone

The majority of respondents (62%) reported having received naloxone in the past for an overdose (Table 1). Of these, 82% described the experience as extremely unpleasant, even "intolerable." Despite past negative experiences, 79% responded

TABLE 2. Participant (N = 82) experiences and attitudes regarding overdose, accessing emergency services, and receiving naloxone

Description	Percentage
Ever witnessed someone else overdose	89
Ever called 911 for an overdose you witnessed	76
The last time someone else overdosed:*	
Attempted lay remedies	90
Attempted cardiopulmonary resuscitation or rescue breathing	55
Called 911	52
Left victim	18
Victim given naloxone by layperson	1
Likely to call 911 right away if witnessed an overdose	55
Would want 911 called right away if they overdosed	74
Would want naloxone administered if they overdosed	79

*Responses are not mutually exclusive, and participants often gave more than one response.

that they would want naloxone administered in the future if they overdosed again, many citing a desire to survive (Table 2).

Attitudes About Participating in an Overdose Management Training Program

The majority of respondents (87%) would participate in a program that would provide take-home naloxone and training in its use and in resuscitation techniques. (Table 3). Some of the reasons for participation included: "Don't want to witness another OD without training"; "Most junkies want to stay alive." On the other hand, 13% would not participate, expressing reservations: "I'm too nervous [to do CPR and give naloxone]"; "My friends could be loaded; don't want them shooting me with naloxone."

Of those interested in receiving naloxone and participating in a training program, the majority (84%) predicted they would carry naloxone with them and show peers how to use it (Table 3): "I'd carry it with me 24/7; you never know when [an overdose] will happen"; "Before I fix, I'd let [friends] know where I keep it." Some participants (16%) would not carry naloxone on their person: "What law says I can walk around with naloxone?" "Could you label it or something?"

Attitudes About Providing Take-Home Naloxone to Injecting Drug Users

There were differing attitudes about the potential consequences of providing take-home naloxone to IDUs (Table 3). A minority (35%) believed that, if they had naloxone, they might feel comfortable using larger amounts of heroin. Comments were as follows: "[Naloxone acts as] a safety net," "the anti-dope," "ensures I won't die." On the other hand, the majority of respondents felt that they would not inject more heroin despite having naloxone: "I'd just do my normal dose; don't want to be dope-sick from naloxone"; "You're not trying to kill yourself; you know your limits." Regarding the possibility that IDUs would be less likely to call 911 for an overdose if they had naloxone, 62% responded that they might be less likely to call: "Eliminates the need for 911, ER, cops, doctors, and bills."

There was concern that IDUs given take-home naloxone might use it to resuscitate a peer, then leave the victim or allow the victim to use more heroin to medicate

TABLE 3. Attitudes about the consequences of an overdose management program for training in the use of naloxone, cardiopulmonary resuscitation, and rescue breathing (N = 82)

Responses	Percentage
Would participate in an overdose management training program	87
Would carry naloxone if trained in its use	84
Would show peers how to use naloxone	84
Would want peers to administer naloxone to them if they overdosed	91
Would feel more comfortable using larger amounts of heroin if had naloxone on hand	35
Would be less likely to call 911 for an overdose if had naloxone	62
Would stay with someone after resuscitating them with naloxone	70
Would allow someone to use more heroin to medicate withdrawal symptoms after giving them naloxone for an overdose	46

the acute withdrawal precipitated by naloxone. Most (70%) responded that they would stay with the victim of the overdose after administering naloxone: "Leaving them is like murder"; "I'm responsible if they died." Some predicted that they would leave the victim primarily because they feared arrest.

DISCUSSION

Overdose is a recurrent event in the lives of these study participants. Similar to other studies,^{12–15,23} the vast majority of participants had witnessed someone else overdose. While this provided an opportunity for medical intervention, only about half of respondents called 911 for the last witnessed overdose, largely due to concerns about police involvement. As other studies have shown,^{12–15} we found the most common response to an overdose was to attempt lay remedies that had little or no physiological basis, yet indicated respondents' altruistic desire to help save a peer.

Similar to a study by Strang et al.¹⁵ in England, we learned that the vast majority of IDUs based in San Francisco who we interviewed were eager to participate in a peer-based overdose management program that would provide "take-home" naloxone and training in its use and in CPR. Our data indicates that there are attempts to help among heroin injectors; almost all reported attempting lay remedies to save an overdose victim, but about half stopped short of calling 911 due to fear of legal repercussions. Regarding the possibility of personal overdose, the majority would want 911 called for them, revealing a strong will to live, which is not always appreciated in this population. Other studies have indicated that overdose is rarely a suicide attempt, but instead, an accident, largely due to fluctuating tolerance in the user and inconsistent purity of heroin.^{29–31} A peer-based overdose management program would potentially allow participants to care for themselves and others, in addition to calling 911, in the event of an overdose. The literature is replete with examples of successful peer intervention programs among drug users.^{32–34}

Similar to previous research, IDUs are often very hesitant to call 911 for fear of notifying the authorities about their drug use, especially if they have outstanding warrants or are on parole.^{10,14–16} Despite our finding that no arrests occurred, police accompanied paramedics about half of the time, and IDUs perceived police as threatening. Recognizing this potentially life-threatening deterrent to emergency assistance, communities might request that law enforcement personnel not accompany paramedics for overdose calls unless necessary, or consider extending legal immunity for IDUs calling 911 for an overdose. In addition, as part of an overdose management program, IDUs could be trained to speak to an emergency dispatcher in such a way as to elicit an appropriate medical response and minimize the likelihood of a police response.¹⁶

We learned that a minority of respondents might feel comfortable using more heroin if they had naloxone on hand. It would therefore be imperative to stress in the course of an overdose management program that possessing naloxone does not guarantee survival after an overdose because peers might not be able to locate the naloxone, or might fail to use it properly or soon enough. IDUs participating in such a program would need to be reminded of the acute unpleasant withdrawal symptoms produced by naloxone and would be instructed to use naloxone with great caution and only if absolutely necessary.

Some respondents expressed concerns about the legality of possessing and using naloxone. Some participants suggested or explained that they might abandon the

victim after resuscitation for fear of arrest. Naloxone is approved by the Food and Drug Administration (FDA) and used by licensed medical personnel in clinical settings. It is not a controlled substance, and there are no legal prohibitions to prescribing naloxone for off-label use.³⁵ Therefore, a physician can legally prescribe naloxone to a heroin-using patient if indicated to prevent a fatal heroin overdose.³⁵ To further protect heroin users from arrest for carrying naloxone, it would be important to label naloxone in accordance with Food and Drug Administration regulations and to notify local authorities.

Another putative concern raised about providing IDUs with naloxone was that if IDUs had access to naloxone, they would be less likely to solicit emergency medical assistance for an overdose. Our results show that currently only about half of respondents surveyed called 911 for an overdose, and that this would not change appreciably if they were provided naloxone. Even when 911 is called, a short response time of 5 minutes could result in irreversible brain injury, which must be weighed against the benefit of immediate access to naloxone to reverse a heroin overdose. In the course of an overdose management program, however, IDUs should be educated that, after resuscitation, overdose victims should be observed by medical personnel for a period of time to ensure they do not relapse or develop subsequent complications of the overdose. Naloxone use by peers would be presented as an adjunct to calling 911, not as an alternative to seeking definitive and professional help.

Participants suggested that peers might abandon a victim after resuscitating them with naloxone or might not be able to prevent them from using more heroin to self-medicate acute withdrawal. These actions could put the victim at risk for dying from an overdose when the naloxone wears off. Studies have shown, however, that mortality from overdose after medical resuscitation with naloxone is rare, and that premature opiate reinjection after resuscitation rarely occurs.^{36–38} Participants in an overdose management training program, therefore, should be educated that the intense withdrawal symptoms precipitated by naloxone generally subside within 20–30 minutes as the naloxone wears off. They should be trained to stay with the victim to provide support and reassurance that withdrawal will diminish and that using more heroin at this time could be life-threatening.

Our results should be considered in light of several limitations. We used a convenience sample recruited from the Urban Health Study population, not a random sample; therefore, our results cannot be generalized to all IDUs. This sample was older, the majority was male, and many were homeless, a sample typical of the Urban Health Study population. Nevertheless, this is a sub-population that suffers significant mortality and morbidity from heroin overdose,^{4,7,39,40} and their opinions about possible life-saving interventions are very important. Furthermore, there may be biases in self-reported accounts of overdose events and attitudes about an overdose management program due to self-selection, social desirability, recall, and intoxication. Previous research, however, has shown high validity in self-report among drug users recruited outside of clinical settings.^{41,42}

CONCLUSION

In summary, this study of 82 street-recruited IDUs in the San Francisco Bay Area underscores the striking recurrence of overdose in the lives of IDUs and the fact that most overdoses are witnessed by injecting companions. Our data show that most IDUs have a strong desire to live and to assist peers to survive an overdose.

Almost all had intervened to save a peer, but due to fear of police involvement, most had resorted to ineffective lay remedies rather than accessing medical services.

The results from this feasibility study and other similar studies^{23,24} indicate that there is a role for peer-based interventions such as naloxone distribution in preventing heroin overdose fatalities, yet there may be some associated risks. Educating the community and emergency response personnel about deterrents to accessing help for heroin overdose could mitigate some of these risks. In addition, another methods to reduce the number of heroin overdose deaths may involve prescribing take-home naloxone to heroin injectors in the context of a multi-faceted overdose management training program in which users are well trained in the use of naloxone, CPR, and calling 911.

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REFERENCES

1. Office of National Drug Control Policy. *What America's Users Spend on Illegal Drugs*. Washington, DC: Executive Office of the President.; 1997.
2. Drucker E, Garfield J. Overdose trends in five US cities: 1988–1997. Paper presented at: Preventing Heroin Overdose: Pragmatic Approaches; January 13–14, 2000; Seattle, WA.
3. Office of Applied Studies (OAS). *Year-end Emergency Department Data From the Drug Abuse Warning Network (DAWN)*. Rockville, MD: Dept of Health and Human Services, Substance Abuse and Mental Health Services Administration; 1999.
4. San Francisco Medical Examiner. *Annual Report*. San Francisco, CA: San Francisco Department of Public Health, 1998–1999.
5. Seal KH, Kral AH, Gee L, et al. Predictors and prevention of nonfatal overdose among street-recruited injection heroin users in the San Francisco Bay Area, 1998–1999. *Am J Public Health*. 2001;91:1842–1846.
6. Darke S, Ross J, Hall W. Overdose among heroin users in Sydney, Australia: I. Prevalence and correlates of non-fatal overdose. *Addiction*. 1996;91:405–411.
7. Darke S, Zador D. Fatal heroin “overdose”: a review. *Addiction*. 1996;91:1765–1772.
8. Zador D, Sunjic, S, Darke, S. Heroin-related deaths in New South Wales, 1992: toxicological findings and circumstances. *Med J Aust*. 1996;164:204–207.
9. Levine B, Green D, Smialek JE. The role of ethanol in heroin deaths. *J Forensic Sci*. 1995;40:808–810.
10. Powis B, Strang J, Griffiths P, et al. Self-reported overdose among injecting drug users in London: extent and nature of the problem. *Addiction*. 1999;94:471–478.
11. Taylor A, Frischer M, Goldberg D. Non-fatal overdosing is related to polydrug use in Glasgow [letter; comment]. *BMJ*. 1996;313:1400–1401.
12. Darke S, Hall W. The distribution of naloxone to heroin users. *Addiction*. 1997;92:1195–1199.
13. Sporer KA. Acute heroin overdose. *Ann Intern Med*. 1999;130:584–590.
14. Darke S, Ross J, Hall W. Overdose among heroin users in Sydney, Australia: II. responses to overdose. *Addiction*. 1996;91:413–417.
15. Strang J, Best D, Man L, Noble A, Gossop M. Peer-initiated overdose resuscitation: fellow drug users could be mobilized to implement resuscitation. *Int J Drug Policy*. 2000;11:437–445.

16. Giuliano R. Drug users' tools of the trade: naloxone and Narcan. *Harm Reduction Commun.* 1999;9:18–19.
17. *Physician's Desk Reference*. Montevale, NJ: Medical Economics; 2000.
18. Shulgin A. *Controlled Substances: Chemical and Legal Guide to Federal Drug Laws*. Berkeley, CA: Ronin Publishing, Inc.; 1992.
19. Goldfrank LR, Hoffman RS. The poisoned patient with altered consciousness. Controversies in the use of a "coma cocktail." *JAMA*. 1995;274:562–569.
20. Dettmer K. Naloxone distribution to drug addicts as a contribution to the prevention of opiate overdose fatalities. Paper presented at: Preventing Heroin Overdose: Pragmatic Approaches; January 13–14, 2000; Seattle, WA.
21. Ronconi S. Prevention of overdoses among current heroin users in Torino, Italy, for the period 1995–1998. Paper presented at: Preventing Heroin Overdose: Pragmatic Approaches; January 13–14, 2000; Seattle, WA.
22. Bigg D. Data on take home naloxone are unclear but not condemnatory [letter]. *BMJ*. 2002;324:678.
23. Strang J, Powis B, Best D, et al. Preventing opiate overdose fatalities with take-home naloxone: pre-launch study of possible impact and acceptability. *Addiction*. 1999;94:199–204.
24. Lenton SR, Hargreaves KM. Should we conduct a trial of distributing naloxone to heroin users for peer administration to prevent fatal overdose? *Med J Aust*. 2000;173:260–263.
25. Watters JK. Trends in risk behavior and HIV seroprevalence in heterosexual injection drug users in San Francisco, 1986–1992. *J Acquir Immune Defic Syndr*. 1994;7:1276–1281.
26. Kral AH, Bluthenthal RN, Lorvick J, Gee L, Bacchetti P, Edlin BR. Sexual transmission of HIV-1 among injection drug users in San Francisco, USA: risk-factor analysis. *Lancet*. 2001;357:1397–1401.
27. Watters JK, Biernacki P. Targeted sampling: options for the study of hidden populations. *Soc Problems*. 1989;36:416–430.
28. Bluthenthal RN, Watters JK. Multimethod research: from targeted sampling to HIV risk behaviors. In: Lambert EY, Ashery RS, Needle RH, eds. *Qualitative Methods in the Prevention of Drug Abuse and HIV Research*. Vol. 157. Rockville, MD: National Institute on Drug Abuse; 1995:212–230.
29. Darke S, Hall W, Weatherburn D, Lind B. Fluctuations in heroin purity and the incidence of fatal heroin overdose. *Drug Alcohol Depend*. 1999;54:155–161.
30. Bammer G, Sengoz A. Non-fatal heroin overdoses [letter]. *Med J Aust* 1994;161:572–573.
31. Gossop M, Griffiths P, Powis B, Williamson S, Strang J. Frequency of non-fatal heroin overdose: survey of heroin users recruited in non-clinical settings. *BMJ*. 1996;313:402.
32. Levy JA, Gallmeier CP, Weibel WW. The outreach assisted peer-support model for controlling drug dependency. *J Drug Issues*. 1995;25:507–529.
33. Hawkins WE, Latkin C, Mandel W, Oziemkowska M. Do actions speak louder than words? Perceived peer influences on needle sharing and cleaning in a sample of injection drug users. *AIDS Educ Prev*. 1999;11:122–131.
34. Broadhead RS, Heckathorn DD, Weakliem DL, et al. Harnessing peer networks as an instrument for AIDS prevention: results from a peer-driven intervention. *Public Health Rep*. 1998;113(Suppl 1):42–57.
35. Burris S, Noreland J, Edlin B. Legal aspects of providing naloxone to heroin users in the United States. *Int J Drug Policy*. 2001;12:237–248.
36. Sporer KA, Firestone J, Isaacs SM. Out-of-hospital treatment of opioid overdoses in an urban setting. *Acad Emerg Med*. 1996;3:660–667.
37. Smith DA, Leake L, Loflin JR, Yealy DM. Is admission after intravenous heroin overdose necessary? *Ann Emerg Med*. 1992;21:1326–1330.
38. Vilke GM, Buchanan J, Dunford JV, Chan TC. Are heroin overdose deaths related to

- patient release after prehospital treatment with naloxone? *Prehosp Emerg Care*. 1999; 3:183–186.
39. Centers for Disease Control and Prevention. Unintentional overdose in King County, Washington, 1990–1999. *MMWR Morb Mortal Wkly Rep*. 2000;49:633–636.
 40. Centers for Disease Control and Prevention. Heroin overdose deaths—Multnomah County, Oregon, 1993–1999. *MMWR Morb Mortal Wkly Rep*. 2000;49:633–636.
 41. Watters JK, Needle R, Brown BS, Weatherby N, Booth R, Williams M. The self-reporting of cocaine use. *JAMA*. 1992;268:2374–2375; [discussion], 2375–2376.
 42. Dowling-Guyer S, Johnson ME, Fisher DG, et al. Reliability of drug users' self-reported HIV risk behaviors and validity of self-reported recent drug use. *Assessment*. 1994;1: 383–392.